FILM THICKNESS MEASUREMENT USING ELECTRON-BEAM INDUCED X-RAY MICROANALYSIS

ABSTRACT OF THE DISCLOSURE

An X-ray micoanalysis test system comprising a beam generator which induces X-rays to emanate from a semiconductor device containing film stacks. The charged particle beam will penetrate at least two layers of a film stack on a semiconductor device so that these layers may be tested. The X-rays will be detected using multiple X-ray detectors that detect X-ray photons having a specific energy level. The X-rays will then be used to analyze the characteristics of the semiconductor device. Each of the multiple X-ray detectors may be wavelength dispersive system (WDS) detectors. The present invention also provides a method for measuring film stack characteristics on a semiconductor device. The method for measuring includes directing an electron beam towards the semiconductor device so that the electron beam penetrates at least a conductive film layer and a liner layer, detecting the X-rays which are caused to emanate from the device with multiple X-ray detectors that detect X-ray photons having a specific energy level. The present invention also provides a method and a computer-readable medium which determines a film stack's properties using the data collected with the test system of the present invention. The method and computer-readable medium includes selecting a set of values which estimate the film stack characteristics, using the estimated values to generate predicted data by solving equations which model the film stack, and selecting a new set of estimated film stack characteristic values when the difference between the predicted data and the raw data is larger than a certain margin of error.